# ANALYSIS OF GAHARU ESSENTIAL OIL USING GC/GCMS

**SHAHRIZAL BIN RAMLI**

**UNIVERSITY COLLEGE OF ENGINEERING & TECHNOLOGY**
**MALAYSIA**

"I hereby acknowledge that I had read this technical writing and in my opinion this technical writing is sufficient in terms of scope and quality for the purpose of the granting of Bachelor of Chemical Engineering."

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| Signature | : …… |
| Name of Supervisor | : Mazni Binti Ismail |
| Date | : 20th November 2006 |

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SHAHRIZAL BIN RAMLI

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of the requirements for the award of the degree of
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# DECLARATION

I declare that this thesis entitled “Analysis of Gaharu Essential oil Using GC/GCMS.” is the result of my own research except as cited in references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.”

Signature :…….

Name of Candidate : Shahrizal Bin Ramli

Date : November 20th , 2006

To my beloved mother, father, brother, sister and friends..

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## ABSTRACT

In this study, 7 samples of Gaharu essential oil from the industries was analyzed using Gas Chromatography/ Gas Chromatography Mass Spectrometry (GC/GCMS). All the 7 samples (G1, G2, G3, SP001, SP002, SP003 and SP004) was identified and analyzed to determine the best quality of Gaharu essential oil. Difference grade of Gaharu contain different percent and different compounds in the essential oil. The best quality of Gaharu essential oil is depends on the important chemical components that contribute to the special characteristic of aroma to Gaharu and the number of components exists in all samples. Agarospirol, jingkoh eremol and kusenol are the important compounds that contribute the characteristic of aroma to Gaharu. Every single oil normally has more than a hundred components and it can be detected through analyzing the essential oil with a chromatograph. The samples will be analyzed by GC/MS equipment. GC/MS equipment have been choose to analyze the chemical components in Gaharu essential oil because this equipment make an effective combination for chemical analysis. The result of this study, sample Gaharu essential oil, G1 is the best quality of essential oil recommended by industry in Malaysia.

## ABSTRAK

Dalam kajian ini, beberapa contoh minyak Gaharu yang telah diambil daripada ondustri akan dianalisa dengan mengunakan alatan Gas Chromatography/ Gas Chromatography Mass Spectrometry ( GC/GCMS ). Terdapat 7 sampel minyak Gaharu ( G1, G2, G3, SP001, SP002, SP003, dan SP004 ) yang dikenalpasti dan dianalisa untuk menentukan contoh minyak yang paling berkualiti. Setiap kayu Gaharu mempunyai kualiti yang berbeza dan ianya akan menghasilkan minyak Gaharu yang berbeza dari segi kehadiran komponen terpenting dan jumlah komponen yang hadir dalam setiap contoh minyak. Minyak Gaharu yang berkualiti ditentukan oleh kehadiran komponen terpenting yang memberikan sifat istimewa pada minyak Gaharu dari segi aromanya. Komponen terpenting ini ialah agarospirol, jinkoh eremol dan khusenol. Minyak Gaharu boleh terdiri daripada lebih seratus komposisi kimia yang dapat ditentukan menggunakan GC/GCMS. Alatan ini dipilih kerana ianya dapat mengesan kehadiran setiap komponen dengan baik. Selepas analisa dijalankan, contoh minyak G1 merupakan contoh minyak Gaharu yang paling berkualiti berdasarkan pengalaman dan rujukan daripada pihak industri di Malaysia.

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## LIST OF SYMBOLS

| | |
|---|---|
| GC | Gas Chromatography - |
| MS - | Mass Spectrometry |
| GC/MS | Gas Chromatography- Mass Spectrometry |
| P - | Pressure |
| T | Temperature |
| F | Flowrate |
| Aquilaria | One if the Gaharu species |
| Agarwood | Others name of Gaharu |
| RI | Retention Time |
| KI | Kovet Index |

## LIST OF APPENDICES

# CHAPTER 1

# INTRODUCTION

## 1.0 Introduction

Gaharu is one of the most expensive woods in the world. It is the occasional product of two to four genera in the family Thymelaeaceae, with *Aquilaria agallocha* and *Aquilaria malaccensis* the best known species. *Aquilaria malaccensis* is a large evergreen tree reaching a height of 25 m or more **[1].** Gaharu oil is a mixture of sesquiterpenes, sesquiterpene alcohols, chromone derivative and resin [**2**].

Gaharu essential oil may consists up to 100 chemical components that give a special characteristic to gaharu essential oil. Agarospirol, jingkoh eremol and kusenol are the important compounds that contribute the characteristic of aroma gaharu [**4**]. Every single oil normally has more than a hundred components and it can be detected through analyzing the essential oil with a chromatograph [**5**].

7 samples of Gaharu from industry ( G1, G2, G3,SP001, SP002, SP003 and SP004 ) will be analyze by GC/MS to identify the best quality of gaharu essential oil. This type of analysis gives information about the individual components of each oil, and their relative amounts. GC/MS equipment have been choose to analyze the chemical components in gaharu essential oil because this equipment make an effective combination for chemical analysis [**3**]. GC/MS is a combination of Gas Chromatography (GC) equipment and Mass Spectrometry (MS) equipment. GC analysis common conformation test. This equipment will separate all components in

a sample and provides a represent spectral output. MS equipment meanwhile commonly used in arson investigation, petroleum product analysis and so on

**Common name for Agarwood [6]**:-

- Agar wood
- Jin Koh
- Aloes wood
- Gaharu
- Eagle Wood
- Jinkoh
- Oud

**Species Of Agarwood** [**7**]:-

- Aquilaria agallocha
- Aquilaria grandiflora
- Aquilaria ophispermum
- Aquilaria sinesis
- Aquilaria crassna
- Aquilari malaccensis
- Aquialaria pentandra
- Aquilaria yunnanensis

**Table 1.0**: Scientific Classification of Gaharu [**7**]

| Scientific Classification | |
|---|---|
| Kingdom | Plantea |
| Division | Mangnoliophyta |
| Class | Mangnoliopsida |
| Order | Malvales |
| Family | Thymelaeaceae |
| Genus | aquilaria |

## 1.1 Objective of the study

The objective of this study is: -

**1)** To developed a standard of industrial grade of Gaharu essential oil quality based on the chemical constituent.

## 1.2 Scope of this study

In this study, 7 samples of Gaharu essential oil (G1, G2, G3, SP001, SP002, SP003, and SP004). will be analyze using GC/MS from industry was analyzed using GC/GCMS.

## 1.3 Problem statement

In Gaharu industrial, actually there are no standard that can be refered to identified and to determined which is the best quality of Gaharu essential oil Nowadays, the best quality of gaharu essential oil is determined by trander and customer and not based on the chemical components exist on the product. This is happen because there is no standard to determined the best quality of Gaharu essential oil. Gaharu essential oil may consist up to 20 components and it can de analyzed by GCMS.

# CHAPTER 2

# LITERATURE REVIEW

## 2.0 Essential oil

Each of the essential oils used in aromatherapy can be used either alone or in combinations to create a desired effect. Essential oil is also known as volatile oil and ethereal oil [**9**]. The essential oil are found in different parts of the plant such as the flowers, twigs, leaves and bark, or in the rind of fruit. For example, in roses essential oils are found in the flowers, in basil it is in the leaves, in sandalwood in the wood, and so on.

According to Ghannadi, the essential oil was analyzed by GC/MS **[9].** Pure essential oils are expensive, but they are also highly effective. Only a few drops at a time are required to achieve the desired aromatherapy effects.

Synthetic oils are available at a lesser price, but they do not have the healing aromatherapy powers of the natural oils. Essential oils have an immediate impact on our sense of smell, also known as olfaction when an essential oil is inhaled, olfactory receptor cells are stimulated and the impulse is transmitted to the emotional center of the brain, or limbic system.

## 2.1 Uses of Essential Oil

In Malaysia, there are recorded of the use of the gaharu in various folk remedies for the treatment of weakness, stomach pains, in pregnancy, after delivery, fever, chest pains, body pains, rheumatism, women dieses and dropsy[**11].** It is reputed to be somatic and sedative, has antibiotic, anti-tumor and anti cancer effect **[12]**

### 2.1.0 Vaporization

The essential oils can help freshen a room or be used to create a special mood. The oils can be used in an oil burner, on a light bulb ring, or in a room spray

## 2.2 Aromatherapy

Aromatherapy is an art, and science, of using essential oil extraction from aromatic response. Essential oil can be combined with massage oil or bath salt to enhance health and beauty.

The essential oil taken from plants and used in Aromatherapy have been describe as their “life force”- they are essential oil the plants biological process, as well as being the substance which gives them their scent. The limbic system is connected to areas of the brain linked to memory, breathing, and blood circulation, as well as the endocrine glands which regulate hormone levels in the body. The properties of the oil, the

fragrance and its effects, determine stimulation of these systems. When used in massage, essential oils are not only inhaled, but absorbed through the skin as well.

They penetrate the tissues and find their way into the bloodstream where they are transported to the organs and systems of the body. Essential oils have differing rates of absorption, generally between 20 minutes and 2 hours, so it is probably best not to bathe or shower directly following a massage to ensure maximum effectiveness. [**10**].

## 2.3 Aquilaria

Aquilaria are recored for peninsular Malaysia and all are believed to be able to produced oleoresins **[13].** A member of the family Thymelaeaceae, *Aquilaria* is a relatively slow-growing, medium-sized tree, on average 15–25 m tall; some of the more than 15 species (e.g., *A. microcarpa*) reach heights of as much as 40 m[**9**]. Having a moderately straight stem, it can achieve a diameter of up to 250 cm, although some species remain considerably smaller and more shrublike, e.g., *A. khasiana.* Most *Aquilaria* species have smooth, thin, pale gray bark with dense, dark foliage of shiny elliptical to oblong leaves (7.5–12 cm long by 2.5–5.5 cm wide).

*Aquilaria* regenerates freely under natural conditions as seedlings around the mother tree or sprouts from the stumps of harvested trees. However, mother trees are becoming scarce in many areas because of over-exploitation. Although this condition may not lead to local extinction of the species, it may severely affect the availability of the product and, thus, the local *gaharu* economy.

## 2.4 Agarwood

Agarwood or eaglewood is one of the most expensive woods in the world. It is the occasional product of two to four genera in the family *Thymelaeaceae*, with *Aquilaria agallocha* and *Aquilaria malaccensis* the best known species [7].

Agarwood is known as “jinko” in Japan, which translates as “sinking incence” or “ incence that sinks in water, “ due to the weight of the resin in the wood.Agarwood, belongs to the genus Aquilaria and to the species Agallocha. It is native to Cambodia, Laos, Vietnam, Indonesia and Northern India, although resources in many of these areas have suffered from unchecked exploitation in recent times. Agarwood tree is a large evergreen tree reaching a height of 25 m or more **[1]**.

The tree bears a fragrant, green and yellowish-white flower (shown on the right Aloeswood is not related to Aloe Vera (Latin name: Aloe barbadensis). Agarwood has a deep, woodsy scent, often described as warm and earthy. The aroma is distinctive and very penetrating. Because the scent is so pleasant, agarwood is used to make essential oil and aloeswood chips, and it is also a prized ingredient of incense in the Middle East and in Japan. The fragrance of aloeswood can vary greatly depending on the country of origin, the density of resin and depending also on the part of the tree from which it is harvested.